The Water Quality of Surface Water and Groundwater in Qala-i-Naw city, Afghanistan

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Objectives

This study aims:

- To assess the concentration of heavy metals.
- To determine if the water is safe for human consumption.

Background

A low percentage of Qala-i-Naw (Q.N) (Fig. 1) and Kabul (KBL) citizens are using tap water, while the remaining have to use unprocessed rainwater and well water as alternative sources of drinking water.

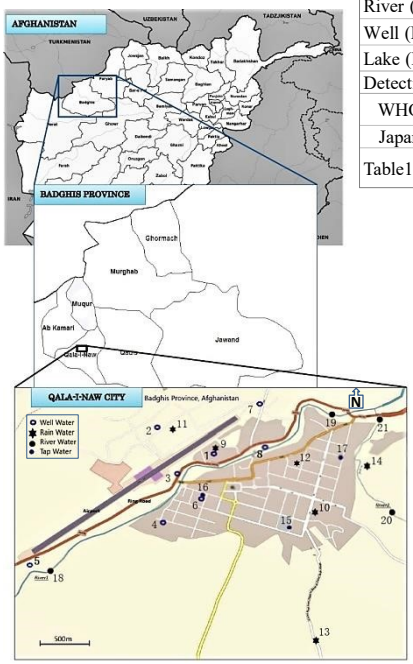

Figure 1. Shows the stations from which the 21 water samples were taken.

Methods

- We collected 26 samples of well-water (12 samples), rainwater (6 samples), river water (4 samples), tap water (3 samples) and lake water (1 sample) from urban areas during March 2018.
- By using Atomic Absorption Spectrophotometer (AAS) we measured the concentration of heavy metals (Zn, Pb, Cu, Cd, Cr, and Fe).

Result and Discussion

- Using galvanized reservoirs *(in which drinking water, especially rainwater is stored more than six months)* have caused a high concentration of Zn in samples 12 and 13.
- Instruments used with hand-pumped wells and metallic reservoirs, have caused a high concentration of Fe in samples 7, 8, 12, 14 and 18, compared with WHO (2011).
- According to official reports, $Pb(C_2H_5)_4$ is still used in Afghanistan as a component of gasoline, therefore 23 out of 26 samples have higher Pb concentration than WHO standards.
- Cr was not detected in 15 samples while 11 samples had Cr concentration higher than the limit of WHO (2011).
- Cu and Cd were found below the safe limit of drinking water standard of WHO.
- The nature of the water seems fresh, because there is no mining, no factories, no traffic load, and no other such activity, but recently; urban growth and deforestations have resulted in some environmental troubles.

Water Category	Zn	Cu	Fe	Pb	Cd	Cr
Well (Q.N)	N.D~0.182	N.D~0.06	N.D~5.17	N.D~0.09	N.D	N.D~0.056
Rain (Q.N)	0.012~12.8	N.D	0.07~3.58	N.D~0.09	N.D	N.D~0.057
Tap (Q.N)	N.D~0.954	N.D	N.D~0.07	0.10~0.16	N.D	N.D~0.056
River (Q.N)	0.006~0.02	N.D	0.15~0.61	0.16~0.19	N.D	N.D~0.128
Well (KBL)	0.016~0.63	N.D~0.06	0.08~0.31	0.19~0.22	N.D	0.14~0.17
Lake (KBL)	N.D	0.076	0.300	0.186	N.D	0.261
Detection Limit	0.005	0.05	0.05	0.05	0.01	0.05
WHO 2011	3	2	0.3	0.01	0.003	0.05
Japan 2015	1	1	0.3	0.01	0.003	0.05

Table1. shows the concentration range of water categories against the WHO and Japan standards (**mg/l**)

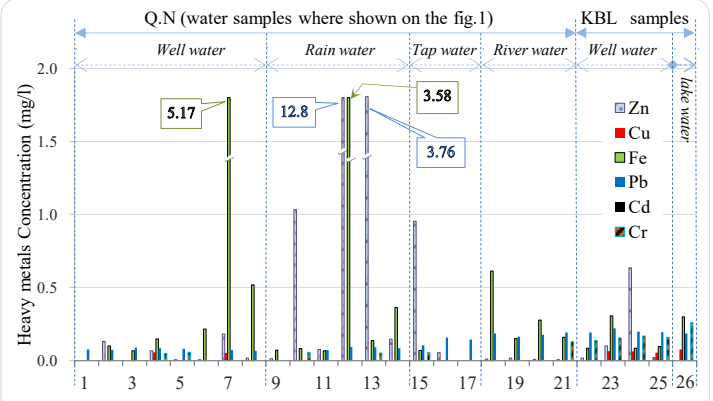

Fig. 2. Shows the sample stations and the concentrations of metals

Conclusion

- Galvanized tanks are gradually dissolved into the water which caused a higher concentration of Zn.
- Metallic parts of hand-pumped wells and metallic tanks possibly contribute to the high concentration of Fe in well water and rainwater.
- Pb is widely released to the environment by engines consumption, since, all sorts of water have polluted by Tetraethyl-lead.
- Cr concentrations in 11 samples were higher than the permissible limit of WHO (2011) and Japan 2015.
- Generally, KBL samples have higher concentrations of Cu, Pb and Cr than Q.N samples.